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DEVELOPMENT OBJECTIVES

Declass Review by NIMA/DOD

MODULATED-LIGHT FILM VIEWING SYSTEM

1. INTRODUCTION.

These objectives propose a feasibility study which would investigate concepts for light-modulating systems and develop the concept(s) most adaptable to two kinds of direct viewing. This would include: (1) contact or 1:1 viewing as is now done on basic light tables by means of transmitted light, and (2) high-magnification, macroscopic viewing afforded, for instance, by a [redacted] Zoom 70 mounted on the same basic table.

STATINTL

2. BACKGROUND.

In the history of photo interpretation, one of the most necessary and basic pieces of viewing equipment has been the direct-viewer light table.

In general format, the viewers are box-like, rectangular in shape, and have either a 10" x 20" or a 10" x 40" viewing surface (opal glass) evenly illuminated from underneath by fluorescent tubes with continuously variable intensity. Film spools and winding gear are located at either 9" end. Both-sized tables are placed on support tables, specially designed, and are used most often to view roll-film positives.

The P.I. uses the 9" x 18" table primarily for contact viewing the standard format films (which range to 9" x 18"): his technique involves first scanning the exposure by naked eye and then studying details with a 7X or 12X tube magnifier. So that the seated P.I. could lean into his work rather than have to lean over it, the table was designed to rotate and tilt on its pedestal: its most familiar working position is at an angle 45° from vertical and away from the seated P.I.

The 9" x 40" light table is more often used in a natural horizontal position (with a long side nearest the P.I.) for larger format and higher-resolution films. Viewing is frequently augmented by a stereomicroscope capable of 7X-60X magnifications.

The illumination system in current models fulfills its basic purpose as a light source. However, a more sophisticated, modulating-light system would be of direct benefit to the intelligence retrieval process. It would not only reduce the physiological strains involved for the human visual system but also enhance the display of photographic information for more effective exploitation.

For example: with current, standard fluorescent illumination of transparencies, there is no means of masking extraneous light or of attenuating light under thin densities and providing adequate brightness under heavy densities. At contact scale, when the P.I. searches for details in dense regions of a transparency, his eye is affected (the iris closes down) by flare either surrounding the transparency or passing through adjacent, thin-density image areas. Particularly trying visual situations are presented by snow, clouds and shadows, and occasionally by haze.

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In addition, a direct-viewer used with a microscope for detecting magnified details often proves inadequate in total illumination level.

3. SCOPE.

Envisioned is a direct-viewer light table built around a modulating illumination system capable of automatically and continuously responding to film densities and spatial frequencies and regulating light accordingly. The effect would be similar to that of a [redacted] printer. STATINTL

All concepts with potential application should be considered: some which were visualized in the course of the original project idea are:

3.1. CRT scanning systems.

3.2. Light-beam scanning systems.

3.3. UV-IR quenching systems.

3.4. Photochromic filter or masking systems.

3.5. Phototropic filter or masking systems.

3.6. Various combinations of the above systems.

3.7. It would be ideal if one concept -- or at least compatible systems -- were applicable to both direct-viewing uses of the light table. On the other hand, it might prove sensible to develop two entirely different principles and, consequently, independent systems.

3.8. Further but secondary considerations should be given to rear-projection viewers and the potential incorporation of light-modulating principles in such equipment.

3.9. Proposals will be evaluated on the basis of the following:

3.9.1. Performance - the degree to which the contractor can assure the customer of meeting the stated requirements.

3.9.2. Simplicity - an approach which implies fewer contingencies, broad application and reasonable economy.

To a certain extent these factors are mutually exclusive; however, each is so important that concurrent development of the most promising proposal for each category is a distinct possibility.

4. REQUIREMENTS.

4.1. Physical Configuration. It is desired that this modulated light system be suitable for packaging in a mode similar to the conventional 10" x 20" or 10" x 40" roll-film viewers. If this is not feasible, then the proposal should include a description of appropriate packaging which will be evaluated for its relative merits as a design concept.

4.1.1. Viewing Area. The entire 10" x 20" or 10" x 40" viewing areas should be illuminated by the modulating system; however, consideration will be given to systems which utilize auxiliary illumination on either end and confine the modulated illumination to the central portion. The minimum acceptable size for the area of the modulated illumination is 9" x 9".

4.1.2. Controls. Controls must be kept to a minimum and should be mounted directly on the viewer. If a separate control console is unavoidable, then it would be acceptable.

4.1.2.1. Modulated Illumination. Controls should be provided for adjusting the degree of modulation in terms of intensity and/or spatial frequency. There should be a control for setting the unmodulated levels of intensity and controls for setting the size and position of the area of modulated illumination.

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4.1.2.2. Auxiliary Illumination. If auxiliary illumination is required to cover the entire specified viewing area, it should be independently variable and completely isolated from the modulated illumination. A means should be provided for instantaneously extinguishing the auxiliary source and illuminating it to a preset level.

4.1.3. Physical Interference. Physical obstructions which come between the operator and his work and which would inhibit viewing or efficiency are not acceptable.

4.2. Illumination Characteristics.

4.2.1. Brightness. Minimum acceptable level of brightness for the entire illuminated area is 1000 foot-lamberts: a level of 2000 foot-lamberts is desired.

4.2.1.1. Brightness Modulation. Brightness modulation shall be a function of density and spatial frequency. Brightness shall be inversely proportional to transmittance and directly proportional to the spatial frequency of the transparency being viewed. These modulations shall be variable in range, allowing for individual operator preference and for the requirements of magnified viewing (5X - 60X).

4.2.1.2. Response Time. Since the viewer is to be used for scanning, the response time of the modulation system must be such that no visually perceptible effects such as flicker or smear are produced.

4.2.1.3. Reduced Field. If possible, masking or size-reduction of the illuminated area should result in a proportionate increase in maximum intensity.

4.2.1.4. Spurious Effects. No spurious effects such as those produced by uni-directional scan, are acceptable. On the other hand, special effects, available at the operator's option, are acceptable.

4.2.2. Color Temperature. Color temperature shall be in the 3500° - 5500°K range and shall not be appreciably changed by brightness attenuation.

4.3. Development Plan. This development shall be executed in two, independent, successive phases: feasibility study and operation of prototype. Contract award shall constitute tentative approval of both phases. No funds will be approved for the operational prototype phase, however, until the customer has given assent on the basis of feasibility studies and breadboard demonstrations. It is the customer's prerogative to terminate without pursuit of the prototype phase if he is not satisfied with the proof of feasibility.

4.3.1. Feasibility Study. This requires detailed documentation of the study program, which should include investigation, analysis and breadboarding. Successful breadboard demonstration must precede the prototype phase.

4.3.2. Operational Prototype. This requires production of a prototype system which can be evaluated operationally with both 1:1 direct viewing and 5X - 60X magnified viewing. The prototype shall include detailed descriptions of all aspects of the systems as well as maintenance and operating instructions.

5. SECONDARY REQUIREMENTS.

These requirements should be considered if they do not compromise those stated in Section 4:

5.1. Masking. The modulated light area should be continuously variable in size. Size should be independently variable in X and Y; identical change in X and Y would be acceptable. Increase in intensity -- in correct proportion to reduction in area -- is desired.

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5.2. Translation. The modulated light area, once reduced in size, should be movable to any desired position within its original boundaries. This translation should be optionally controlled -- either manually (by a joy-stick) or automatically (by the position of the viewing microscope).

5.3. Enhancement. Other special optical effects made possible by a modulating light source should be considered.

5.4. Rear-Projection Viewers. If a similar light modulation technique could be applied to rear-projection viewers, which have a magnification range of 5X-50X and a screen size of 30" x 30", there is interest in establishing its feasibility.

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